

IN THE UNITED STATES DISTRICT COURT
FOR THE NORTHERN DISTRICT OF OKLAHOMA

STATE OF OKLAHOMA, *et al.*,)
)
Plaintiffs,)
)
v.)
)
TYSON FOODS, INC., *et al.*,)
)
Defendants.)

Case No. 4:05-cv-00329-GKF-PJC

DEFENDANTS' REPLY IN SUPPORT OF MOTION TO EXCLUDE
THE TESTIMONY OF DR. BERNARD ENGEL PURSUANT TO
DAUBERT v. MERRELL PHARMACEUTICALS, INC. [DKT #2056]

Defendants respectfully reply to Plaintiffs' Response to Defendants' Motion to Exclude the Testimony of Dr. Bernard Engel Pursuant to *Daubert v. Merrell Pharmaceuticals, Inc.* ("Pltfs.' Resp.") [Dkt No. 2157]. Plaintiffs' response and the accompanying 33-page declaration by Dr. Engel completely fail to substantiate the reliability of Dr. Engel's modeling and source allocation opinions.¹ Rather than explain and defend what Dr. Engel actually did to arrive at his challenged opinions, Plaintiffs' response is devoted to criticizing the defense expert that uncovered the substantial errors in that work and recasting the arguments put forward by Defendants in the hope that this Court will lose sight of the actual, substantial flaws identified in Defendants' motion. Dr. Engel's modeling work for the Plaintiffs is so lacking in scientific validity and demonstrably in error that to allow testimony before the jury would be improper under *Daubert* and its progeny. The State's arguments in support of Dr. Engel's testimony are ineffective and do not rehabilitate the unreliable modeling opinions put forth in Dr. Engel's Report. Therefore, the Court should grant Defendants' Motion to Exclude. [Dkt. No. 2056]

I. Plaintiffs Cannot Dispute Many of the Problems Identified by Defendants

Plaintiffs fail to challenge much of the record before the Court with respect to the errors, faulty methods, and erroneous assumptions that underlie Dr. Engel's modeling and source allocation opinions. Plaintiffs admit that Dr. Engel made substantial mistakes in his work that

¹ Dr. Engel's Declaration (Exh. C to Pltfs.' Resp., [Dkt. No. 2157]) amounts to an improper supplemental expert report. The Court has correctly denied prior requests by Plaintiffs for leave to submit reports to "bolster" prior opinions. *See* Opinion and Order, Dkt. No. 1839 (Jan 29, 2009). In his declaration, Dr. Engel offers lengthy observation and analysis not previously included in his expert report or disclosed in his deposition in an attempt to explain his work and substantiate or bolster his opinions. Defendants have filed a motion to strike this and numerous other improper declarations submitted by Plaintiffs in connection with recent filings. *See* Defendants' Mtn. to Strike Pltfs.' New and Undisclosed Expert Opinions [Misc. Exhibits to Dkt. Nos. 2058, 2064, 2071, 2072, 2074, 2083, 2103, 2116, 2130, 2156, 2158, and 2198] [Dkt. No. 2241].

were identified by defense expert Dr. Bierman. *See* Pltfs. Resp., pp. 18-19.² Plaintiffs admit that Dr. Engel performed no sensitivity analysis to determine the impact on his modeling results of the uncertainty in his input data. *Id.*, p. 17. Plaintiffs do not effectively challenge Defendants' observation that Dr. Engel ignored specific EPA guidance to calibrate and validate the results of his GLEAMS model predictions of non-point source run-off losses by comparing those predictions to edge-of-field data for the IRW. *Id.*, p. 16.³ Finally, Plaintiffs do not dispute the results of the tests performed by Dr. Bierman showing that Dr. Engel's routing model yields the same result regardless of whether one uses the phosphorus load predictions used by Dr. Engel or truly random inputs such as the average S&P 500 daily index or a point source discharge equivalent to 97 million people as opposed to the estimated 280,000 people served by POTWS in

² Plaintiffs' claims that Dr. Bierman lacks the qualifications and requisite experience to review and comment upon Dr. Engel's work (*see* Pltfs.' Resp., 5-7) ring particularly hollow given that Dr. Bierman discovered the errors which resulted in numerous errata reports by Dr. Engel. *See* Exh. 2 to Defs' Mtn., Engel Dep., pp. 39:19-24; 66:14-67:15. In effect, by filing an errata every time Dr. Bierman identified a mistake in his work, Dr. Engel admitted that Dr. Bierman's criticisms were well-founded. The State previously filed a baseless *Daubert* motion challenging Dr. Bierman's qualifications to offer such criticisms [Dkt. No. 2063]. Defendants refer the Court to the response to the State's motion filed on June 5, 2009 [Dkt. No. 2138] for a full description of Dr. Bierman's work, qualifications, and the basis for his opinions.

³ Plaintiffs attempt to avoid the consequences of this clear breach of recognized scientific protocol by pointing to language in a "general disclaimer" to the EPA Guidance Document which states that the document "does not impose legally binding requirements" and "may not apply to a particular situation." Pltfs.' Resp., p. 10; Exh. C to Pltfs.' Resp., Engel Decl., ¶ 8. However, in EPA's own words, this document was prepared to "recommend best practices to help determine when a model, despite its uncertainties, can be appropriately used to inform a decision." Exh. 11 to Defs. Mot., EPA Guidance, p. vii. Specifically, it recommends that model developers and users: (a) subject the model to credible, objective peer-review; (b) assess the quality of the data used; (c) corroborate the model by evaluating the degree to which it corresponds to the system being modeled; and perform sensitivity and uncertainty analyses." *Id.* General disclaimer or not, Dr. Engel's failure to adhere to EPA's "recommended best practices" in his modeling work should weigh heavily in this Court's analysis of the reliability of his modeling opinions. Dr. Engel's suggestion in his declaration that this EPA Guidance is not applicable to "hydrologic models" demonstrates either his willingness to misrepresent the truth or his failure to actually read EPA's Guidance before dismissing it, as the document states: "The principles and practices described in this Guidance are designed to *apply generally to all types of models*" *Id.*, 3. Appendix B to the EPA Guidance specifically lists the type of models covered and includes fate and transport models and surface water quality models. *Id.*, pp. 50-51.

the IRW. *Id.*, p. 19.⁴ Plaintiffs admit that Dr. Engel's predictions about phosphorus levels in Lake Tenkiller are based upon the untenable assumption that no changes will occur in weather patterns, land uses, residential or industrial development, or growth in the human population in the IRW within the next 50 to 100 years. *Id.*, p. 15. While Plaintiffs ask this Court to blindly accept their assurances that such problems do not undermine the reliability of the challenged opinions, they cannot, and do not, dispute the record put forward by Defendants on these issues.

II. Plaintiffs Have Not Justified Dr. Engel's Application of GLEAMS in the IRW

Plaintiffs and Dr. Engel pretend in their response as though Defendants have argued that no hydrologic model has ever been used reliably by any scientist on any watershed in the world. From this false premise, Plaintiffs and Dr. Engel set out to show that other scientists have used hydrologic models, including GLEAMS, to simulate phosphorus loadings to water bodies and that the results of that work, by other scientists, have been peer-reviewed and published. Pltfs.' Resp., pp. 7-9; Exh. C to Pltfs.' Resp., Engel Decl. ¶¶ 9-15. The question before the Court is not whether the peer-reviewed modeling work of some other scientist in some other setting with respect to different land use areas or water bodies is reliable. The question is whether Dr. Engel's work in this litigation is scientifically valid and reliable as required by Rule 702.⁵

⁴ Although Dr. Bierman's sensitivity analysis demonstrates the lack of validity associated with Dr. Engel's modeling methodology, there are also indications that Dr. Engel's models are conceptually flawed and unreliable which are demonstrable, which are contained fully within Dr. Engel's body of work, and which do not depend on Dr. Bierman's analysis, opinions, or qualifications. Specifically, Dr. Engel's linked modeling system predicts the same phosphorus loads to Lake Tenkiller for phosphorus runoff from half of the total IRW land area as it does for the entire land area of the IRW. *See* Exh. 1, Bierman Aff., ¶ 14.

⁵ Defendants made clear that their motion challenges the specific configuration and application of the GLEAMS model by Dr. Engel in this case. Defendants predicted that Plaintiffs would attempt to distort their position: "Plaintiffs may argue that the conclusions reached by Dr. Engel are inherently reliable because he used a model that has been used by others in the scientific community and is the subject of the various peer-reviewed, published papers. Of course, whether the GLEAMS model has ever been used in some other setting by someone other than Dr. Engel to produce reliable and realistic results is not the test for

As stated in Defendants' Motion, when considering a *Daubert* challenge a district court should both examine the general methodology used by the expert and also assess the reliability of the expert's application of the particular methodology to the data and facts of each particular case. *See* Defs.' Mtn., p. 11. In the Tenth Circuit, an experts' testimony is unreliable "whether [it] completely changes a reliable methodology or merely misapplies that methodology." *Oklahoma v. Tyson Foods*, 565 F.3d 769, 780 (10th Cir. 2009) (quotations omitted).

Defendants demonstrated in their motion that the way in which Dr. Engel applied the GLEAMS model to the facts involved in this case was not a scientifically valid methodology, and Plaintiffs' response does nothing to justify Dr. Engel's methods. Defendants pointed out in their Motion that the EPA has warned modelers that the GLEAMS model is "not suited for bigger watersheds," should be "limited to an agricultural field of a very small size," and is "not suited for urban land uses." Exh. 7 to Defs' Mtn., *TMDL Model Evaluation and Research Needs* (2005), pp. 210–11. Plaintiffs offer no cogent explanation as to how Dr. Engel's modeling work in this case can be reliable given the undisputed facts that the IRW is a large watershed with large agricultural fields and a thriving urban area at the headwaters of the Illinois River.

Plaintiffs' attempted defense of Dr. Engel's failure to use realistic assumptions about poultry litter applications in his configuration of the GLEAMS model for this case is equally unpersuasive. Plaintiffs claim that Dr. Engel's assumptions concerning when, where and how poultry litter is applied "*were reasonable*." Pltfs.' Resp., pp. 14-15. Of course, the issue this Court must resolve as the "gatekeeper" under *Daubert* is whether Dr. Engel's opinions are *reliable*. *Daubert*, 509 U.S. at 589. Opinions based upon assumptions that are demonstrably wrong cannot be reliable. As detailed in Defendants' Motion, Dr. Engel's assumptions about where, when and how litter is applied in the IRW and at what rates are clearly inaccurate. Exh. 2

admissibility of Dr. Engel's opinions in this case. The issue before the Court is whether Dr. Engel's work and opinions in this case are reliable." Defs.' Mot., p. 10.

to Defs.’ Mtn., Engel Dep., pp. 246:7–254:15; 256:23–258:21. His only explanation for his wildly inaccurate assumptions is that “for purposes of the model study, it wasn’t necessary to reflect the actual spreading patterns.” *Id.*, pp. 255:17– 256:8.⁶ Because Dr. Engel used inaccurate assumptions about the amount of poultry litter applied in the IRW and the locations and methods associated with such applications, his opinions regarding the relative contribution of poultry litter applications to real-world phosphorus loads cannot meet the *Daubert* standard of reliability.

Dr. Engel’s reliance upon the work of other scientists with GLEAMS in other settings is misplaced. As Dr. Bierman explains, none of the studies or peer-reviewed articles cited by Dr. Engel discuss, much less, substantiate the methods and assumptions Dr. Engel incorporated into his configuration of the GLEAMS model in this case. *See* Exh. 1, Bierman Aff., ¶¶ 4-5. Dr. Engel set up, configured and applied the GLEAMS model for purposes of this lawsuit in ways that differ substantially from the work of other modelers. Defendants have demonstrated how Dr. Engel’s misapplication of the GLEAMS model to the IRW and the fault assumptions fed by him into the model invalidate the modeling results which he wants to offer to the jury as “evidence.” Plaintiffs’ response does nothing to demonstrate the reliability of those opinions.

III. Dr. Engel’s “Source Allocation Method” Is Not Based Upon Generally Accepted or Peer-Reviewed Methods and is Unreliable

The “source allocation method” Dr. Engel used *outside of his GLEAMS and routing models* is fundamentally flawed, untested, and unreliable methodology. This allocation methodology is the source of Dr. Engel’s ultimate opinion that “poultry waste application within

⁶ Plaintiffs’ argument that Defendants cannot challenge the accuracy of Dr. Engel’s assumptions on these important issues because “Dr. Bierman did no study of how and when poultry litter is applied in the IRW” (*see* Pltfs.’ Resp., p. 14) is a non sequitur given that Dr. Engel admits that his assumptions are inconsistent with the real world rates of litter application, which are well documented. *See* Exh. 2 to Defs.’ Mtn., Engel Dep., pp. 318:25-325:12.

the IRW represents 45% of the P loads to Lake Tenkiller between 1998 and 2006 and 59% of the P loads to Lake Tenkiller for the years 2003-2006.” Ex. 1, Engel Rpt., p. 93.

Rather than defend, or even explain,⁷ the allocation method utilized by Dr. Engel in this case, Plaintiffs and Dr. Engel offer this Court only the vague and meaningless observation that there are “many examples from peer reviewed publications where allocations techniques his (sic) employed have been used by others.” Pltfs. Resp., p. 8. This misses the point completely. Dr. Engel used an allocation method in this case, outside of the GLEAMS model, ***that has never been used before***, to arrive at his 45% and 59% relative contributions for poultry litter that, and Dr. Engel has previously admitted that his methods have never before been described in any piece of peer-reviewed scientific literature. Exh. 2 to Defs.’ Mtn., Engel Dep., pp. 345:19-348:17. Dr. Engel’s assertions that phosphorus loads are routinely “allocated among sources” as part of TMDL studies performed by EPA and environmental agencies (Exh. C to Pltfs.’ Mtn., Engel Decl., ¶ 12) and that other scientists have allocated “pollutant proportions” to sources “using various approaches” are meaningless unless the allocation methods used by these studies are the same methods he employed in his work in this case. They are not. *See* Exh. 1, Bierman Aff. ¶ 8.

Plaintiffs argue that Dr. Engel's failure to account for all sources of phosphorus in the IRW does not affect the reliability of his source allocation work despite the legal authority cited in Defendants’ motion rejecting similarly flawed expert work. Pltfs.’ Resp., p. 11.⁸ Dr. Engel

⁷ Dr. Jeon developed and implemented the allocation method Plaintiffs and Dr. Engel say is reliable. Dr. Engel could not even explain the allocation method during his deposition and admitted that his report does not describe how the 45% and 59% relative contribution figures for poultry litter were derived. Exh. 2 to Defs.’ Mtn., Engel Dep., pp. 337:3-13, 341:15-19, 382:25-386:1, 389:7-21.

⁸ Defendants cited *City of Wichita v. Trustees of APCO Oil Corp. Liquidating Trust*, 306 F.Supp.2d 1040 (D. Kan. 2003) and *Kalamazoo River Study Group v. Eaton Corp.*, 258 F.Supp.2d 736 (W.D. Mich. 2002) for the general proposition that an expert must consider alternative sources. Plaintiffs argue, based upon factual distinctions, that these cases do not

accounted for only four sources of phosphorus: poultry litter, manure from other animals, commercial fertilizer, and WWTPs (Exh. 1 to Defs.' Mtn., Engel Rpt., pp. D-18 to D-19), and ignored numerous others. Exh. 6 to Defs.' Mtn., Bierman Rpt., p. 11. For Dr. Engel to consider a point or non-point phosphorus source significant enough to include in his allocation work, the source had to contribute 2% of total phosphorus to the IRW. Exh. 1 to Defs.' Mtn., Engel Rpt., p. D-41. Plaintiffs now claim that Dr. Engel did in fact consider sources such as stream bank erosion, septic tanks, sewage bypasses at treatment plants, and commercial fertilizer imported into the IRW and that he determined these sources were too small to be of any consequence. Pltfs.' Resp., p. 11. However, Dr. Engel never investigated the aggregate effect of ignoring smaller sources. Exh. 6 to Defs.' Mtn., Bierman Rpt., p. 11. Although each source Dr. Engel elected not to include in his source allocation work may have only contributed a small percentage of the total phosphorus in the IRW, the combined effect could be substantial, meaning that the relative contributions of each phosphorus source *included* in Dr. Engel's models is overstated. *See id*

IV. Dr. Engel's "Routing Model" is Not Based Upon Generally Accepted or Peer-Reviewed Methods

Dr. Engel has admitted that his routing model or equation was developed specifically for this case (Exh. 2 to Defs.' Mtn., Engel Dep., p. 190:22-24) and that he cannot identify "any peer-reviewed study in which [his routing equation] has been used to simulate the physical processes that occur as phosphorus moves from the edge of field downstream to a reservoir." *Id.*, pp. 191:3-7; 192:9. Additionally, Dr. Engel attempts to validate his empirical model by equating it with other empirical models, including the USGS LOADEST program. *See* Exh. C to Pltfs.' Resp., Engel Declaration, ¶ 11. While the form of equations used in Dr. Engel's routing model

apply here. Plaintiffs are incorrect; their factual distinctions render inapplicable the general statements of law contained in these cases.

are similar to the form of equations used in LOADEST, the models are fundamentally different. *See* Exh. 1, Bierman Aff., ¶ 7. The USGS's use of LOADEST in the IRW does not confer legitimacy on Dr. Engel's routing model or its application to predict phosphorus loads to Lake Tenkiller. *Id.*

V. Dr. Engel Did Not Follow His Own Peer-Reviewed Protocol for Hydrological/Water Quality Modeling

Dr. Engel claims in his declaration (Exh. C to Pltfs.' Resp., ¶16) that his modeling protocol followed the methods set forth in his peer-reviewed paper (Engel, et al., 2007). This claim is demonstrably false. As explained by Dr. Bierman in his report, Dr. Engel failed 1) to provide sufficient information for his modeling operations to be reproduced or for another modeler to duplicate Dr. Engel's calibration method, even with access to the model and the data used in the calibration process, 2) to take into account all available data when he specified inputs for his GLEAMS model, 3) to accomplish the sediment calibration step for both his GLEAMS model and his routing model, and 4) to show a line of 1:1 correspondence for any of his calibration or purported validation results for his predicted phosphorus loads. Exh. 6 to Defs.' Mtn, Bierman Rpt, pp. 21-25; Exh. 1, Bierman Aff., ¶ 12. These, among other omissions and errors, directly contradict the protocol set forth in Engel et al., 2007.

VI. Dr. Engel Did Not Test his Model in a Scientifically Reliable and Valid Manner

Plaintiffs allege that Dr. Engel's model "is not only capable of being tested; it has already been tested by two methods – calibration and validation." Pltfs.' Resp., p. 16. Dr. Engel notes that the GLEAMS and phosphorus routing modeling system were calibrated and validated following protocol outlined in Appendix D of his report and that the process used was "typical of hydrologic/water quality monitoring." Exh. C to Pltfs.' Resp., Engel Decl., ¶ 28. Plaintiffs have again missed the point of Defendants' challenge to Dr. Engel's work. Plaintiffs' references to peer-reviewed studies discussing tests performed by other scientists on models that were

configured differently than Dr. Engel's configuration of GLEAMS in this case do not excuse them from demonstrating that the methods Dr. Engel actually used were reliable when applied to the particular data and facts of this case. Plaintiffs do not fulfill this obligation. Dr. Engel's model is site-specific and it is nonsensical to compare it to other site-specific models.

As a preliminary matter, Dr. Engel failed to conduct a sensitivity analysis with respect to his GLEAMS model. Defs.' Mtn., p. 17 (citing to Exh. 2, Engel Dep., p. 464). In prior testimony before this Court, Dr. Engel has noted the importance of a sensitivity analysis. *Id.* (citing to Exh. 3 to Defs.' Mtn., Hrg. Tr., p. 462). Plaintiffs claim that "[g]iven the extensive use of the GLEAMS model reported in the peer-reviewed literature (so how it performs is well established) and Dr. Engel's experience with the GLEAMS model, sensitivity analysis is neither required nor important." Pltfs.' Resp, p. 17. Despite Plaintiffs' broad reference to peer-reviewed literature, they do not address the concerns raised by Defendants and noted by the EPA regarding application of the GLEAMS model to a 1.1 million acre watershed with a diverse array of land uses. *See* Defs.' Mtn., pp. 11-12. Given Plaintiffs' novel application of the GLEAMS model, a sensitivity analysis was necessary to test whether GLEAMS is appropriate for this case. *See* Bierman Rpt., pp. 15-19.

Though Plaintiffs purposefully failed to run such an analysis, the errors Dr. Bierman identified that lead to Dr. Engel's first errata provide the Court with a *de facto* sensitivity analysis of Dr. Engel's entire linked modeling system. *See* Exh. 1, Bierman Aff., ¶ 14. Dr. Engel divided the IRW into 50 hydrologic response units ("HRUs"), separated among three sub-watersheds. Due to miscommunication between Dr. Engel and Dr. Jeon, the modeling results in Dr. Engel's May 2008 report were based on non-point source loads from only 27 of the 50 HRU's, representing only 52 percent of the pasture land area in the IRW. *Id.* After learning of this error, Dr. Engel issued an errata correcting the tables and figures in his report. By his own

admission, this mistake “did not result in significant changes to figures and tables.” Exh. C to Pltfs.’ Resp., Engel Decl., ¶ 41. This means that Dr. Engel’s linked modeling system gives the same answers for predicted phosphorus loads to Lake Tenkiller for half of the pasture land area as it does for all of the pasture land area. *See* Exh. 1, Bierman Aff., ¶ 14. This incredible result is precisely the scenario addressed by a sensitivity analysis and is proof of the unreliability of Engel’s model.

Plaintiffs also contend that Dr. Engel did not need to independently calibrate the GLEAMS model with edge of field phosphorus data. They claim independent calibration was unnecessary and attempt to support this claim by again pointing to literature. Exh. C to Pltfs.’ Resp., Engel Decl., ¶ 29. Once again, the literature cited does not stand for Plaintiffs’ proposition. *See* Exh. 1, Bierman Aff., ¶ 11. As recognized by EPA site-specific calibration in linked model systems is important when (as Engel did here) the model is used to predict watershed scale loadings to lakes. Defs.’ Mtn., pp. 19-20. Without these independent calibrations, Dr. Engel’s modeling system is unreliable. By calibrating both the GLEAMS model and the routing model with his observed phosphorus loads to Lake Tenkiller, Dr. Engel gave his linked modeling system the desired outcome so that regardless of what inputs are used, it provides the desired results. *See* Defs.’ Mtn., pp. 20-21. While there may be literature supporting a few of the elements Dr. Engel included in his linked model, his actual application of the model to this case and his failure to properly apply the models to the data available render the process unreliable. Despite Dr. Engel’s claims, his work has not and cannot be tested.

CONCLUSION

For the foregoing reasons, the Court should grant Defendants’ Motion to Exclude the Testimony of Dr. Bernard Engel Pursuant to *Daubert v. Merrell Pharmaceuticals, Inc.* [Dkt #2056].

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I also hereby certify that I served the attached documents by United States Postal Service, proper postage paid, on the following who are not registered participants of the ECF System:

Mr. J.D. Strong
Secretary of the Environment
State of Oklahoma
3800 North Classen
Oklahoma City, OK 73118

/s/ Michael R. Bond
Michael R. Bond